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Slag in Wet Process Cement Manufacture

Further Data on Wet Process of Portland Cement Manufacture When Blast Furnace Slag and Limestone are Used as Material

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In the February number of CONCRETE, W. H. Blatchley made a very interesting suggestion by publishing an article entitled "The Wet Process in Blast Furnace Slag Limestone Cement Manufacture, as Viewed by a Western Metallurgist."

The granulated blast furnace slag contains commonly some 20% or more of moisture and frequently the water content reaches up to 50%, when the slag is freshly granulated.

In the ordinary dry process of cement manufacture using granulated blast furnace slag and limestone, the former should be previously dried in the dryer for grinding, and owing to the heavy content of moisture, this process of drying is a much greater task than the drying of ordinary argillaceous raw materials.

In the modern method of manufacture of portland cement, the wet process is often preferred to the dry process even if hard limestone and ordinary clay are used as raw materials, not only because of the efficient fine grinding and utmost uniformity of the kiln feed raw mixture and consequently the product of better quality resulting, but also because the success of the waste heat utilization in this process has reduced the difference of manufacturing cost between the two processes to the minimum. If this is true, the manufacture using granulated blast furnace slag and limestone as raw materials should, of cause, be planned by the wet process, provided there is no trouble with the slurry from these materials.

The common blast furnace slag has almost no hydraulic property at all, when it is slowly cooled; but when it is granulated by sudden cooling with water, it gains hydraulic property, which Zulkowsky investigated 25 years ago.

When the granulated slag and limestone are very finely ground wet in the tube mill, the slurry must show some hydraulic property and there is risk of its setting in reservoir and pipes when it is not in motion.

Two kinds of granulated blast furnace slag (*A* and *B*) were taken and each ground in a ball mill to the fineness that the residue remaining on a sieve of 4,900 meshes per sq. cm. was 6% (about 91% passed through No. 200 sieve) in one case and in the other case 12% was retained (about 85% passed through No. 200 sieve).

The setting and hardening properties were tested on the slag powder and the mixture with different percentages of limestone powder of nearly the same fineness as the slag, so as to make ordinary portland cement raw slurry.

The chemical composition of the slag is shown in Table I.

The setting property was tested with the Vicat's apparatus, which is generally used for determining the time of setting of portland cement, holding the consistency of the slurry paste strictly as fixed in the standard method of testing, and the hardening property was measured by the neat tensile strength of the slags and their mixtures with limestone powder.

The results of tests are tabulated in Table II.

As is shown in the Table II, the slags themselves have quick setting and hardening property and even if they are mixed with limestone powder of 150% of their own weight, they have, to our surprise, very quick setting and pretty high hardening properties.

As these tests were carried out with less percentages of

TABLE I—CHEMICAL COMPOSITION OF GRANULATED BLAST FURNACE SLAG

	Insol. resid.	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Ig. loss	Total
Slag A	1.16	36.11	7.10	0.21	45.06	1.78	2.69	7.00	99.95
Slag B	0.96	37.91	7.55	2.36	45.90	2.41	2.19	1.65	99.97

TABLE II—SETTING AND HARDENING PROPERTIES OF SLAGS AND THEIR MIXTURES WITH LIMESTONE

Mixing Proportion in weight			Fineness Res. %	Setting Properties								Neat Tensile Strength Lbs. per square inch			
				At Common Temperature				At Higher Temperatures							
Slag A	Slag B	Limestone	4900 sieve	Water %	Initial	Final	Temp. of air	Water %	Initial	Final	Mean Temp. of air and water	Water %	1 W	4 W	Combined hardening *
					hr.:min.	hr.:min.	oc.		hr.:min.	hr.:min.	oc.				
100	0	0	6.0	28.5	0:10	1:48	24.1	30.0	1:8	2:48	38.0	30.0	268	323	250
0	100	0	6.0	28.0	1:27	3:47	24.1	30.0	0:56	2:16	38.0	30.0	287	311	257
100	0	0	12.0	28.0	0:5	1:27	24.1	30.0	1:2	2:32	38.0	30.0	235	320	265
0	100	0	12.0	28.5	1:28	3:53	24.1	30.0	1:20	2:40	38.0	30.0	285	324	270
50	0	50	6.0	26.5	1:11	3:34	24.1	28.0	0:50	2:25	38.0	28.0	246	305	169
0	50	50	6.0	26.0	1:6	2:55	24.1	28.0	1:44	3:4	38.0	28.0	221	309	167
50	0	50	12.0	26.0	0:14	2:49	24.1	28.0	1:12	2:22	38.0	28.0	250	303	165
0	50	50	12.0	26.0	0:52	3:40	24.1	28.0	2:15	3:20	38.0	28.0	248	298	169
70	0	30	6.0	26.0	0:25	3:20	24.1	28.0	1:40	2:39	38.0	28.0	220	274	178
0	70	30	6.0	26.0	1:2	3:32	24.1	28.0	1:18	2:38	38.0	28.0	220	283	167
70	0	30	12.0	26.0	0:20	3:00	24.1	28.0	1:38	2:26	38.0	28.0	252	278	167
0	70	30	12.0	26.5	0:19	3:55	24.1	28.0	1:55	3:15	38.0	28.0	235	292	162
40	0	60	6.0	27.5	1:18	4:30	24.1	28.0	1:24	3:20	38.0	28.0	250	305	239
0	40	60	6.0	26.5	2:17	5:7	24.1	28.0	1:43	3:48	38.0	28.0	229	278	303
40	0	60	12.0	27.5	0:7	2:9	24.1	30.0	1:22	2:22	38.0	28.0	265	283	233
0	40	60	12.0	26.0	0:22	4:57	24.1	30.0	2:30	5:10	38.0	28.0	265	316	263

*Combined hardening: Hardening one day in moist chamber, 6 days in fresh water, 21 days in air as applied in the German Standard Method of Cement Testing.

TABLE III—FINENESS AND MIXING PROPORTION

	Fineness		Mixing Proportion					
	Residue on Sieve of		In Weight Gr.			In Percentage		
	4900/sq. cm.	9700/sq. cm.	Mix. A	Mix. B	Mix. C	Mix. A	Mix. B	Mix. C
Slag	0.00%	1.00%	744	820	....	37.2	41.0	....
Limestone	0.10%	1.20%	1226	1140	1560	61.3	57.0	78.0
Clay	0.10%	1.00%	....	....	440	....	....	22.0
Pyrite Cinder	0.15%	2.20%	30	40	....	1.5	2.0	....
Mixture A	0.02%	1.00%	....	....	....	....	....	....
Mixture B	0.02%	0.93%	....	....	....	....	....	....
Mixture C	0.03%	1.00%	....	....	....	....	....	....

TABLE IV—CONSISTENCY AND SETTING PROPERTY OF SLURRY PASTE

Time Elapsed After Gauging	Average Temperature of Air °C.	Mixture A					Mixture B					Mixture C				
		% Addition of Water					% Addition of Water					% Addition of Water				
		30	32	34	36	38	30	32	34	36	38	30	32	34	36	38
		% Water Content in Slurry					% Water Content in Slurry					% Water Content in Slurry				
		23.1	24.2	25.4	26.5	27.5	23.1	24.2	25.4	26.5	27.5	23.1	24.2	25.4	26.5	27.5
hr.:min.																
5:30	25.8	9.0	2.0	2.0	0.5	0.5	6.0	1.5	1.0	0.5	0.5	1.0	1.0	0.5	0.5	0
22:10	26.4	33.0	8.5	7.5	1.0	1.0	20.0	6.0	7.5	1.5	1.5	1.0	1.0	0	0.5	0
30:0	26.4	36.0	24.0	16.0	3.0	2.0	34.0	15.0	19.0	6.0	3.0	24.0	3.5	0.5	0	0
49:40	24.4	....	34.8	32.5	30.8	30.5	30.0	32.3	31.0	31.0	31.5	32.0	31.5	30.0	19.5	3.5
71:25	24.4	set	37.0	36.5	36.5	34.0	....	36.5	....	35.0	35.0	36.0	36.0	35.5	32.0	27.0
77:40	24.4	....	....	36.5	36.5	35.0	set	....	....	35.0	....	36.0	36.0	35.0	34.0	29.0
94:40	26.3	....	....	....	....	....	....	set	set	....	....	....	36.5	35.5	34.0	29.0
101:40	26.3	....	....	....	....	....	....	....	....	....	....	....	36.5	36.0	34.5	31.0
118:40	27.7	....	set	set	....	....	....	....	....	set	set	....	....	....	34.5	32.0
125:40	27.7	....	....	....	....	....	....	....	....	....	....	set	....	....	....	32.5
142:40	26.5	....	....	....	set	set	....	....	....	....	....	....	....	....	....	....
149:40	26.5	....	....	....	....	....	....	....	....	....	....	....	set	set	set	....
166:40	26.0	....	....	....	....	....	....	....	....	....	....	....	....	....	....	set

water than is commonly used for the slurry in the wet process, I have prepared slurries of higher water content of varying percentages ranging from 30 to 38% of dry powder, and tested their setting property.

Table III shows their fineness and proportions of mixing; the mixtures *A* and *B* being of granulated slag and limestone, while the mixture *C* is of limestone and clay, as is used in the common method of manufacture.

At first the change of consistency of the slurry paste was tested. It was measured by the height in mm. of the lower end of the normal rod of one centimeter diameter of 300 grms. above the bottom of the paste vessel, and the final set was determined by the normal needle of one sq. mm. weighing 300 grms.

The result of tests are shown in Table IV.

It can be seen from Table IV, that the paste thickens gradually as the time elapsed after it is gauged and finally reaches to the final set and that the setting is delayed by the increased addition of water, as could be expected; and the mixtures *A* and *B*, which are of blast furnace slag and limestone, set much more quickly than the mixture *C* which is of limestone and clay.

This result indicates that the slurries *A* and *B*, if they are allowed to remain motionless about one and a half days, will be apt to become too stiffened to be put in motion, while the slurry *C* remains still soft enough to be again conveyed.

In modern wet process plants for cement manufacture, waste heat boilers are often installed and in this case the kiln dust settles in the flue and the dust chamber, and is recovered and ground again, mixed with the raw slurry in the tube mills.

The kiln dust contains quick lime and fine cement clinker besides raw powder. The quick lime, becoming slaked when mixed with the slurry, increases the setting property of the latter, as proved by the following experiments.

The granulated slag, limestone and clay were sepa-

TABLE V—FINENESS OF RAW INGREDIENTS AND THEIR MIXTURES USED FOR TESTING THE SETTING PROPERTY OF SLURRIES WITH ADDITION OF SLAKED LIME AND PORTLAND CEMENT

Proportion of Mixture							Fineness; Resid. on Sieve of	
	Slag	Lime-stone	Clay	Pyrite Cinder	Slaked Lime	Cement	4900 per sq. cm.	9700 per sq. cm.
	100	......	......	......	......	......	4.0	5.6
	......	100	......	......	......	......	3.8	5.2
	......	......	100	......	......	......	3.2	4.5
	......	......	......	100	......	......	3.6	5.0
Mixture A	37.2	61.3	......	1.5	0	......	2.0	3.5
	37.2	61.3	......	1.5	3	......	2.0	4.0
	37.2	61.3	......	1.5	6	......	2.2	3.8
Mixture B	41.0	57.0	......	2.0	0	......	4.0	5.8
	41.0	57.0	......	2.0	3	......	4.0	5.0
	41.0	57.0	......	2.0	6	......	4.0	6.0
Mixture C	......	78.0	22.0	......	0	......	2.5	3.6
	......	78.0	22.0	......	3	......	2.4	4.0
	......	78.0	22.0	......	6	......	2.4	4.2
Mixture A	37.2	61.3	......	1.5	......	2	2.4	4.2
	37.2	61.3	......	1.5	......	6	3.0	4.5
Mixture B	41.0	57.0	......	2.0	......	2	3.2	5.2
	41.0	57.0	......	2.0	......	6	3.5	5.1
Mixture C	......	78.0	22.0	......	......	2	2.5	4.0
	......	78.0	22.0	......	......	6	3.0	4.2

rately ground and three mixtures prepared as was previously shown in table III, to make portland cement raw slurry.

To the mixtures were added varying percentages of slaked lime and portland cement. Table V shows the fineness and mixing proportions.

The slurries were put into standard vessels of Vicat's apparatus and placed under water to avoid stiffening, owing to the drying of the paste, and the setting properties tested by frequently lowering the normal needle into the paste. Table VI shows the results of tests with addition of slaked lime.

Although the slurry *C* is of thicker consistency at the time of gauging than *A* and *B*, its setting is much slower than the other two.

With additions of portland cement, as is shown in Table VII, the behavior of each slurry is nearly the same as in the case with slaked lime, except in the case of the addition of 6% cement, in which the time of setting of the slurry *C* seems to be somewhat shorter than that of the other two.

Considering that the kiln dust has commonly quite trifling content of sintered cement, the influence of the latter upon the setting property of the slurry *C* should be inferred from the results of zero and 2% addition.

From the several experiments above described, it can be concluded, that the slurry from granulated blast fur-

TABLE VI—SETTING PROPERTY OF SLURRIES OF DIFFERENT MIXTURE WITH VARYING ADDITIONS OF SLAKED LIME.

(The figures indicate the depth of paste in m.m. penetrated by normal needle of Vicat's apparatus.)

% of Water Added	Time Elapsed After Gauging	Temperature of Air °C.	A Hydrated Lime Added, %			B Hydrated Lime Added, %			C Hydrated Lime Added, %		
			0	3	6	0	3	6	0	3	6
24	Consistency at Gauging		1	31.5	33.0	0	11.0	31.5	28.0	38.0	39.0
	hr.:min.										
	17:49	23.5	40	3.0	1.5	40	39.0	17.5	40	40	40
	19:49	......	......	......	set	......	......	......	......	......	......
	25:49	23.5	40	set	......	40	2.0	set	40	40	40
	30:4	......	......	......	......	......	set	......	40	40	40
	41:49	24.0	40	......	......	initial 39	......	......	40	40	40
	49:49	24.0	40	......	......	38	......	......	40	40	40
	65:49	24.2	40	......	......	38	......	......	40	initial 39	initial 39
	73:49	24.2	initial 39	......	......	31	......	......	40	28	30
	89:49	24.0	30	......	......	25	......	......	40	28	27
	97:49	24.0	30	......	......	25	......	......	40	14	18
26	Consistency at Gauging		0	2.0	14.0	0	1.5	12.0	1.0	36.0	36.0
	17:44	......	40	13	3	40	40	40	40	40	40
	21:44	......	40	......	set	40	......	......	40	40	40
	25:44	......	40	set	......	40	37	2	40	40	40
	31:09	......	40	......	......	40	......	set	40	40	40
	41:44	......	40	......	......	40	set	......	40	40	40
	49:44	......	40	......	......	40	......	......	40	40	40
	73:49	......	40	......	......	40	......	......	40	initial 39	initial 39
	89:49	......	40	......	......	40	......	......	40	38	38
	137:49	......	40	......	......	40	......	......	40	38	38
	145:49	......	initial 39	......	......	initial 39	......	......	40	33	32
	166:49	......	36	......	......	35	......	......	40	28	32
	169:49	......	35	......	......	35	......	......	40	20	28
	185:49	......	35	......	......	35	......	......	40	15	23
	209:49	......	28	......	......	25	......	......	40	11	13
	217:49	......	27	......	......	24	......	......	40	2.5	2.5
	505:49	......	......	......	......	......	......	......	40	set	set
30	Consistency at Gauging		0	0	0	0	0	0	0	1.0	10.0
	17:40	......	40	40	25	40	40	40	40	40	40
	25:40	......	40	1.0	set	40	40	initial 39	40	40	40
	30:55	......	......	set	......	......	......	......	......	......	......
	33:40	......	40	......	......	40	......	set	40	40	40
	35:40	......	40	......	......	40	set	......	40	40	40
	217:40	......	40	......	......	40	......	......	40	40	40
	329:40	......	40	......	......	40	......	......	40	40	initial 39
	353:40	......	40	......	......	40	......	......	40	initial 39	......
	553:40	......	initial 39	......	......	initial 39	......	......	40	......	......
34	Consistency at Gauging		0	0	0	0	0	0	0	0	0
	17:36	......	40	40	40	40	40	40	40	40	40
	25:36	......	40	37	10	40	40	40	40	40	40
	36:10	......	40	......	set	40	40	......	40	40	40
	38:25	......	40	......	......	40	......	set	40	40	40
	41:36	......	40	......	......	40	0.5	......	40	40	40
	42:27	......	40	set	......	40	......	......	40	40	40
	48:10	......	40	......	......	40	set	......	40	40	40
	49:36	......	40	......	......	40	......	......	40	40	40
	448:30	......	40	......	......	40	......	......	40	40	initial 39
	577:2	......	40	......	......	40	......	......	40	initial 39	......

TABLE VII—SETTING PROPERTY OF SLURRIES OF DIFFERENT MIXTURES WITH VARYING ADDITION OF PORTLAND CEMENT

% of Water Added	Time Elapsed After Gauging	Temperature of Water °C.	A Cement Added, %			B Cement Added, %			C Cement Added, %		
			0	2	6	0	2	6	0	2	6
24.0	Consistency at gauging, m/m.		1	15	20	0	2	16	28	36	35
	hr.:min.										
	1:41	24.0									initial
	2:17	24.0								initial	
	2:25	24.0		initial							
	2:30	24.0			initial						
	3:50	24.0					initial				
	4:7	24.0						initial			
	10:30	24.0			set						
	10:45	24.0		set							
	12:11	24.0									set
	13:7	24.0						set			
	15:50	24.0					set				
	16:35	24.0									
	27:25	24.2				initial					
	41:49	24.2								set	
	73:49	24.2	initial								
	97:49	24.2							not yet begun		
26.0	Consistency at gauging m/m.		0	0	0	0	0	0	1.0	26	26
	hr.:min.										
	1:57	24.0									initial
	2:40	24.0		initial							
	3:47	24.0			initial						
	4:2	24.0								initial	
	4:26	24.0					initial				
	10:45	24.0						initial			
	11:57	24.0			set						
	13:45	24.0						set			
	14:7	24.0									set
	15:10	24.0		set							
	16:39	24.2								2.5	
	16:46	24.2					set				
	24:39	24.2								1.0	
	40:22	24.0								set	
	121:49	24.0	not yet begun			not yet begun			not yet begun		
30.0	Consistency at gauging m/m.		0	0	0	0	0	0	0	0	0
	hr.:min.										
	3:54	24.0									initial
	6:35	24.0		initial							
	6:54	24.0			initial						
	11:49	24.0								initial	
	13:22	24.0						initial			
	13:42	24.0					initial				
	13:54	24.0			set						
	14:42	24.0						set			
	16:35	34.0					1.0			33	
	17:5	24.0		set							
	20:28	24.0									set
	24:35	24.2								25	
	24:42	24.2					set				
	40:35	24.0								9	
	48:35	24.2								3	
	88:35	24.2								1	
	144:19	24.3								set	
	145:40	....	not yet begun			not yet begun			not yet begun		
34.0	Consistency at gauging m/m.		0	0	0	0	0	0	0	0	0
	hr.:min.										
	9:0	24.0									initial
	12:17	24.0			initial						
	13:47	24.0		initial							
	15:12	24.0			set						
	15:40	24.0					initial				
	16:28	24.0						initial			
	20:28	24.2						set			
	22:0	24.0									set
	24:15	24.2								initial	
	31:0	24.0		set							
	48:40	24.2					set				
	64:31	24.2								24.5	
	72:31	24.2								19.0	
	88:31	24.2								14.0	
	96:31	24.2								8	
	112:31	24.3								5	
	120:31	23.8								3	
	136:31	24.4								2	
	144:31	24.4								2	
	160:31	24.5								1.5	
	243:0	....	not yet begun			not yet begun			not yet begun		
	504:15	26.0								set	

nace slag and limestone is apt to settle hard in the reservoir and transportation lines during the stoppage of agitating and pumping equipment, and for this reason the special care should be taken in the installation of suitable equipment, by which the slurry can be put in incessant motion, or it can be promptly emptied from reservoirs and pipes, even if a short stoppage of the agitating machines and pumps is unavoidable.

The hurried change of process, as soon as it was put into operation from wet to dry in a cement works in northern Europe, which is said to have been built some ten years ago, seems to have its cause in the considerable trouble, experienced with the slurry from granulated slag and limestone, and if it had been properly designed to treat the slurry having hydraulic properties, the wet process of manufacture should have been assuredly crowned with success.

I wonder why almost all the cement works, using blast furnace slag and limestone as raw materials, have been built to operate by the dry process only, and appreciate that the newly built cement works, which Mr. Blatchley recently visited, is working quite smoothly by the wet process with the slag-limestone slurry, as a model of cleanliness and orderliness, practically free from dust, and believe that from now on the wet process of manufacture of portland cement using blast furnace slag and limestone will prevail much more than the dry process, because the wet process is quite natural for the working with granulated slag containing large percentages of water.

Cuban Portland Cement Co. Enlarges Plant

Fourth Kiln Unit to Increase Daily Capacity to 5,000 Bbls.

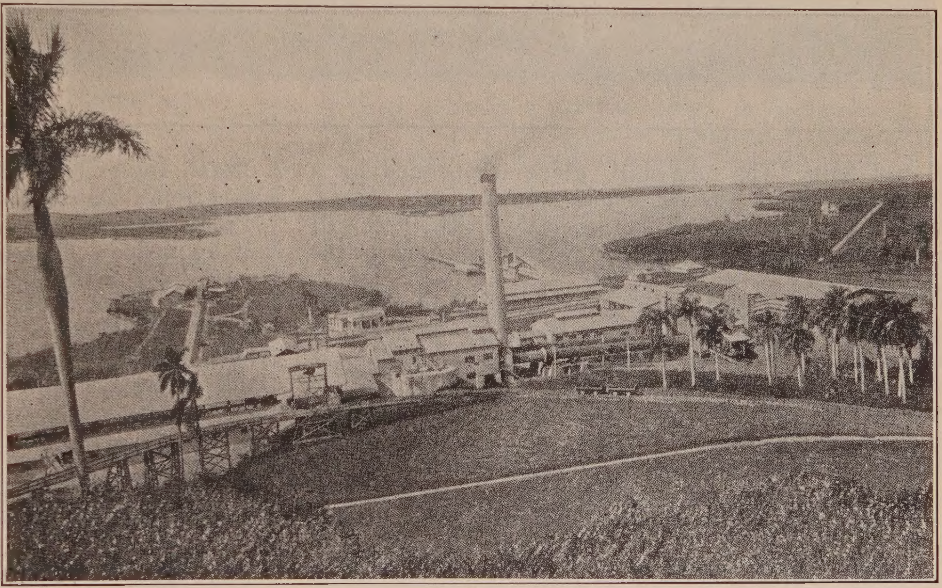

Fig. 1—General view of Cuban Portland Cement Company's plant showing shipping dock in the background, view before new kilns were added

The property of the Cuban Portland Cement Corp. is located on Mariel Bay, on the north coast of Cuba, approximately 25 miles west of Havana, and comprises in the neighborhood of 1,350 acres. Extensive tests have been made of the quarry property and at the present rate of consumption a sufficient supply of raw materials is assured for 200 years. The plant, which has been in continuous operation since 1918, is modern in every respect and had, until 1924 a daily output of 2,000 bbls. when a third kiln was installed increasing the capacity to 3,000 bbls. of "El Morro" brand portland cement, made by the wet blending process. Under this process absolute control of quality is possible and the maintenance of uniformity is assured. Because of the characteristics of the wet blending process and the careful supervision which has been exercised by the Cuban company, the product, El Morro cement, enjoys an enviable reputation for extremely high quality throughout the island. All buildings and docks are of steel and reinforced concrete.

Work was commenced earlier in the year on the foundations for the fourth kiln which will give the plant a total of 5,000 bbls. per day. At the same time work was in progress on the installation of waste heat boilers with a view to taking advantage of the hot gas from the kilns to produce the necessary steam to operate an additional Curtis steam turbine[1] of 3,000 KWH, together with additional grinding units capable of producing 6,000 bbls. per day. This will take care of the entire requirements of portland cement for the island of Cuba.

Crude oil is used throughout the mill as fuel. Tank steamers discharge direct to a 70,000 bbl. concrete storage tank, from which is drawn approximately 1,500 bbls. daily. The quarry equipment now consists of two 76-B Marion oil burning steam shovels[2] for handling rock; one No. 3 Thew electric revolving shovel[3] for clay handling, and three 30-ton Vulcan standard gauge locomotives.[4] The quarry equipment is being reinforced by the addition of one 125-ft. electric shovel for handling rock. The material is loaded into 8-yard steel cars and dumped with Sprague electric hoists[1] into the crusher.

The crushing plant consists of a No. 18 McCully gyratory crusher,[5] one Jumbo Williams hammer mill[6] and one Jeffrey hammer mill.[7]

The material is then mixed with water, further broken down with a Bradley Hercules mill[8] and passed through a 7 x 26 Allis-Chalmers tube mill[9] charged with 45 tons

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[1] General Electric Co., Schenectady, N. Y.
[2] Marion Steam Shovel Co., Marion, O.
[3] Thew Shovel Co., Lorain, O.
[4] Vulcan Iron Works, Wilkes Barre, Pa.
[5] Allis-Chalmers Mfg. Co., Milwaukee, Wis.
[6] Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.
[7] Jeffrey Mfg. Co., Columbus, O.
[8] Bradley Pulverizer Co., Allentown, Pa.
[9] Allis-Chalmers Mfg. Co., Milwaukee, Wis.

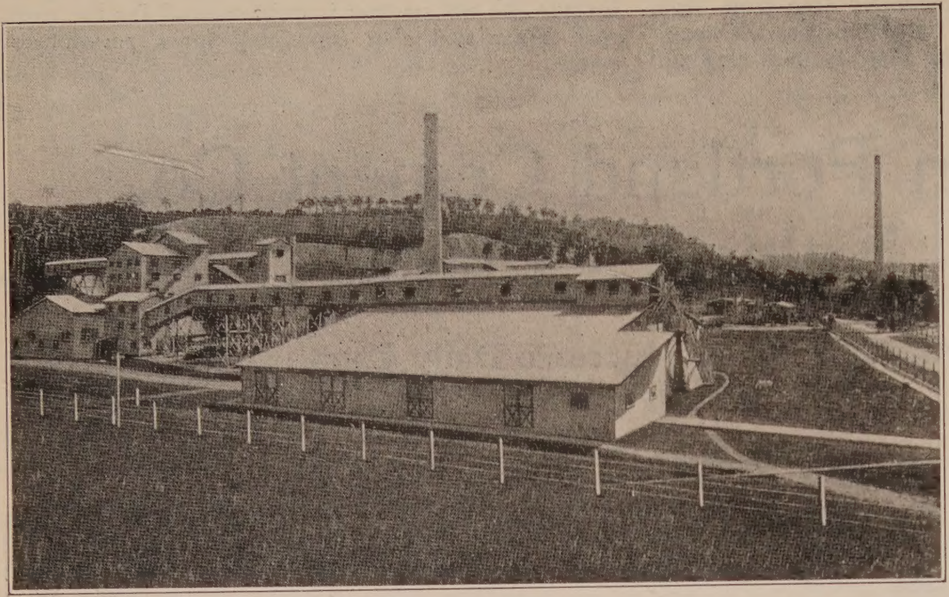

Fig. 2—General view of Cuban plant with quarry in the background

of steel balls. The tube mill, which is operated by a 500 h. p. General Electric motor,[1] rotates at high speed, the steel balls pulverizing the material so that 95% will pass through a 200 mesh sieve (40,000 openings to the square inch).

This slurry is next passed to one of eight concrete tanks 16 ft. in diameter by 25 ft. high. The chemist, by means of an automatic sampler, secures a continuous sample of the slurry as it leaves the tube mill, on which tests are run every hour day and night. In this way an absolute check is kept on the percentages of lime, silica, alumina and iron, the four principal materials found in portland cement, and since the eight slurry tanks are connected one with the other and each with the correction tank, the problem of bringing a uniform, absolutely perfect mix to the correction tank, from which it is fed to the kilns for burning, is simply mathematical.

The slurry, containing 36% of water, is burned in three (the fourth unit being under construction) 9 x 125 ft. rotary kilns at a temperature of approximately 3,000° F., discharging by gravity the red hot clinker into three 6 x 53 ft. coolers. The kilns are lined with 9-in. high temperature refractory brick. The coolers are simply unlined shells. Both kilns and coolers were manufactured by the Vulcan Iron Works. The fuel oil is injected by means of air atomized oil burners with air supplied by a 22x16 Ingersoll-Rand direct connected compression,[10] giving a uniform flame about 35 ft. in length.

From the coolers the clinker, varying in size up to half an inch in diameter, and glass hard, is stored or passed direct to the finish grinding mill, where approximately 2½% of gypsum is added to control the setting time of the cement. The finish mill, a duplicate grinding unit to the one in the raw department, consists of a Bradley Hercules mill[8] and a 7 x 26-ft. Allis-Chalmers tube mill,[9] and completes the actual manufacturing process.

The storage for the finished cement consists of five rectangular concrete bins having a capacity of 6,000 bbls. each and four 32 x 80 ft. concrete silos, with complementary star bins of 85,000-bbl. capacity, making a total storage space of 115,000 bbls.

From the storage the cement is conveyed on a 30-ft. belt to the packhouse located on the dock, and it is there packed in standard packages of cloth and wood; 95 lbs. to the bag, four bags equaling one barrel, and paper lined barrels of 380 lbs. net. This latter package, due to the cumbersomeness and economic loss, is fast becoming obsolete.

Practically the entire tonnage is shipped by water. The packhouse is located on a 500-ft. concrete dock, along-

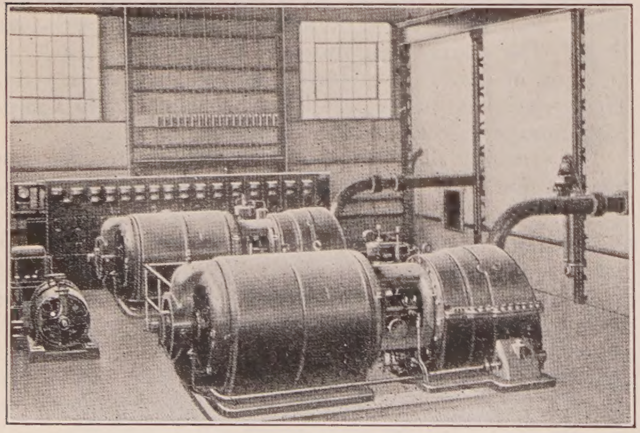

Fig. 3—Interior view of powerhouse showing two of the 1,500 KVA turbo-generators and switchboard

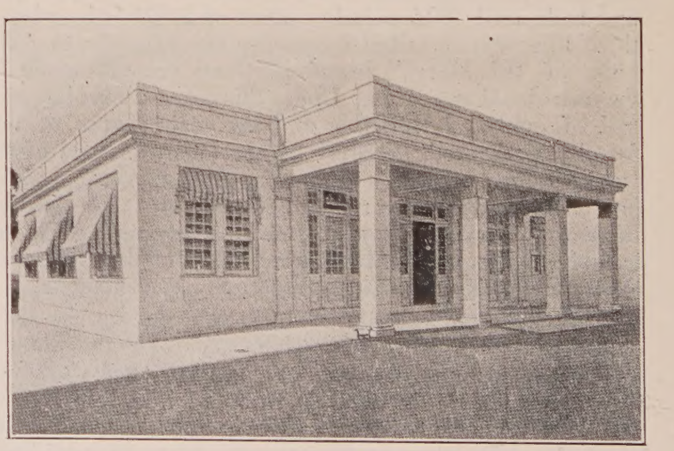

Fig. 4—General view of office and laboratory, Cuban cement plant

side of which there is 27 ft. of water. The company maintains its own tug and fleet of barges and distributes the cement in Havana for shipment throughout the island. Some deliveries are also made direct to the consumer from the Mariel dock.

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[10] Ingersoll Rand Co., New York City.

There is now under construction in Havana, in addition to a modern concrete dock, two cement silos of 16,000 bbls. capacity each, into which the cement is delivered from Mariel in steel barges, equipped with Fuller-Kinyon pumps,[11] in bulk and the cement packed in bags for delivery in Havana as well as by rail to interior points of the island; this new storage guaranteeing a continuous and steady supply to the consumer.

Three hundred and fifty men are employed in operation, of whom 90% are Cubans.

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[11] Fuller Lehigh Co., Fullerton, Pa.

Air Separation in Conjunction with Grinding

By G. F. METZ
Hardinge Co., Inc.

In the following article based upon an address given recently as a part of the Students' Course Program at the Tenth Exposition of Chemical Industries, the conclusion is drawn that it is evident that there are two distinct methods of air classification and conveying: the unit, comprising a combination of grinding mill, air separator and pneumatic conveyor, and the other comprising three separate units, the mill, the bucket elevator and the slow speed air separator or classifier. Each method has its advantages and best fields of use as will be apparent upon close analysis of the various requirements and attendant problems that could use the one or the other form of air separation or classification to considerable advantage.

The application of the principles of air separation or classification to various types of grinding machinery has of late years become accepted practice because of the marked economies that can be effected where fine, dry, ground products are desired.

There are primarily two distinct methods of application, namely air separation as an integral part of certain types of grinding machines and air classifiers operating in conjunction with, but as separate auxiliaries to, the grinding equipment.

Under the former heading we have first the well known high speed roller or ball pulverizer using the principle of air suction through the grinding zone, with the separator placed directly above this zone. The separation of coarse from fine material is effected by passing the dust-laden air from a high velocity zone into a zone of low velocity. The coarse material is dropped back into the grinding zone while the fine material is sucked through the exhaust fan and conveyed under pressure to a cyclone collector set any convenient height above the floor and usually directly over the finished storage bin. The return air from the cyclone collector is piped back to the grinding mill and blown into the grinding zone through openings under the grinding rings, thus completing the cycle. Owing to the particular construction of these mills it is necessary to handle a relatively large volume of air to remove all of the relatively fine material from the grinding zone. Considerable power is, therefore, required to handle this volume of air.

It is apparent that without air separation this type of grinding mill would revert to a class of pulverizer adequate only for granular or intermediate grinding where its inherent disadvantage from a repair standpoint, as compared with slower moving heavy duty grinding equipment, would soon eliminate it as a competitor in this field.

Modified Air Separation Mills

There are several modifications of this type of air separation mill designed primarily for moderately fine grinding work. The writer refers particularly to the pulverizing of bituminous coal for boiler firing where it is necessary to pulverize only to about 85 to 90% through 100 mesh. With this type a rough separation is accomplished in a large separating chamber set directly over the grinding zone. In this zone of lower velocity the coarse particles fall, against the fan suction, back into the grinding zone. The application of this principle is the same whether the pulverizing is accomplished by rolls against a vertical or horizontal die ring, or by large balls; although the arrangement with the latter type is slightly different. It is also applied in conjunction with high speed hammer or beater mills which are extensively used in the chemical industry.

The next type of air separation is that which is applied to tube mills and conical mills. Under the first, we have the so-called air-swept system while under the latter the unique principle of reverse air currents. The air-swept system as applied to a tube mill consists of drawing air through the mill by means of an exhaust fan placed close to the discharge end of the mill. This dust laden air is then passed to a cyclone dust collector set directly over the finished material bin. The return air is piped back to both the feed and discharge end of the mill, suitable valves being placed in the return piping to regulate the amount of air going to either end of the mill. An auxiliary cyclone collector is sometimes placed at the point where the return air leaves the cyclone in order to minimize dust losses at the air vent.

This system is best suited for use where a moderately fine ground product is desired, namely, where a fineness of not over 80 to 85% passing a two hundred mesh is desired. It has been found that while air sweeping a mill of this type increases its capacity by the quick removal of finished material from the grinding zone, this is true only where the fineness desired is of a moderate degree. Where extreme fineness with little or no oversize is required the fan suction has to be cut to an absolute minimum. This allows a great deal of finished material to remain in the mill cushioning the grinding action and materially cutting down its capacity. It is practically impossible to make a uniform finely ground product free from oversize by simply using air suction without exact classification. It is also necessary to feed this type of mill with material relatively fine in order to eliminate coarse oversize in the finished product.

Air Separation with Reverse Air Currents

A later type of the unit air separation system employing the principle of reverse air currents is now being used in connection with the intermediate and exceedingly fine grinding of dry materials such as coal, limestone, calcined clay, sulphur and various chemicals in the conical mill. The shape of this mill lends itself readily to the principles of air separation. Two designs are employed, one for use in connection with conical ball or pebble mills grinding to a fineness between 60 mesh and 75% through 200 mesh and the other where the fineness required is in excess of 75% through 200 mesh and up to as fine as 99½% through 325 mesh in some cases. In either case, a distinct separation of coarse from fine material takes place and the speed of the exhaust fan remains constant.

The Rotary Classifier

For a fineness of from 60 mesh to 75% through 200 mesh what is known as a rotary classifier is used with the ball mill. This classifier is attached to the end of the mill and revolved with it. Air is drawn through the discharge end of the mill by means of an exhauster, and as the mill rotates stirring up this material, the finer particles are carried through by the air. Other fine particles which may not be lifted up, as well as some oversize may discharge in the ordinary manner by flowing out of the discharge opening. The air, in passing through the mill picks out the finer particles and to some extent the coarse product. In the rotary classifier, the coarse particles, owing to low velocity in this section settle out and drop on the shell of the classifier. The finer particles are carried over and into the discharge pipe connected to cyclone collector and the exhauster. The oversize is conveyed by a helix on the inside of the rotary classifier shell back to small buckets. These buckets lift the material and drop it in a shower over and around the hopper. The coarse particles drop into the hopper and are blown back into the mill by the returning air in the inner pipe with sufficient velocity to send them into the grinding zone. The finer particles are again sucked out by the air and carried forward. This creates a circuit in which the fine particles remain in the classifier until they are sucked out by the fan and not allowed to go back with the oversize, thus making a very efficient classification. The finished material is conveyed under suction to a cyclone dust collector and the returning air after passing through the exhauster is piped back to the classifier to be used for forcing the oversize into the grinding zone.

Double Classification for Extremely Fine Grinding

Where a product of finer than 75% through 200 mesh and in some cases as fine as 99½% through 325 mesh is desired, a modification of the above system is used in connection with the conical ball mill. This is known as the rotary and superfine classifier and embodies the principle of double classification. It is also possible, with this system to obtain two products, one very fine, and the other granular, as the latter can be obtained by bypassing the oversize return from the superfine and secondary classifier.

The rotating part of the superfine classifier is similar to that of the rotary classifier previously described except that this classifier is somewhat smaller and is not adjustable. A rough classification which consists of removing all tramp oversize and superlative coarse oversize is effected at the rotary classifier, buckets being used to lift this oversize and drop it back into the return air pipe so as to blow it back into the mill. The semi classified and thoroughly diffused product passes up through the superfine classifier wherein adjustments for fineness are made. This classifier is a double cone arrangement similar in some respects to some of those now on the market, but using a different method of separation. In both rotary and rotary with superfine classifiers as applied to conical mills the classifiers and main collector are on the suction side of the fan thus eliminating wear on the fan blades by having the fan handle pure air only.

What is true of the roller or high speed pulverizer mill is also true to a certain extent of the ball mill and short tube mill in that without the foregoing air classification the mill reverts to the primary or moderately fine grinding machine although in the latter class the ball mill is becoming more or less standard due to its inherent ability to grind both soft and hard materials at a low repair and power cost. Where air classification is used in connection with grinding mills built as a unit system employing air suction it has been found that materials containing a greater amount of moisture than before can be handled successfully.

Air Classifiers as Auxiliaries to Grinding Mills

We now come to the air classifiers or separators used as auxiliaries to the grinding mills. The usual procedure in this case is to pass the discharge from the grinding mill by elevators to the classifier wherein a separation of coarse material from fine takes place, the coarse material being returned to the feed end of the grinding mill for regrinding. This procedure necessitates the use of elevators and conveyors which are additional auxiliaries and which add to the expense of operation. Elevators and conveyors also have a tendency to cause shut downs. This feature is objectionable not only from this standpoint but it has been found that it is almost impossible to keep down the dust in such an installation.

There are three types of classifiers used in this manner. The first type to be considered is very much similar to the separator used in connection with the high speed roll pulverizer, namely, a double cone effect using an exhaust fan to create the suction. The material is fed from the pulverizer into the separator through a rotary feeder. It passes upward between the outer shell of the inner cone at high velocity, then through openings into the inner cone where the air strikes a zone of low velocity, dropping out the coarse material while the fines go on through the exhauster into a cyclone dust collector. The return air is piped back to the separator and enters again at the tailings spout at a point below the feeder. Adjustment for fineness is made by means of deflector vanes at the point where the dust laden stream passes from the zone of high velocity to that of low velocity.

The next type and one which is used a great deal consists of an outer cylindrical light gauge steel shell varying from 8 ft. to 14 ft. in diameter to the bottom of which is attached a light gauge steel cone. Brackets support a steel inner shell known as the separating chamber. Under this is another cone with a pipe leading to the outside known as the tailings cone. A hollow shaft carrying a distributing plate at the bottom, a large fan at the top and centrifugal vanes just above the distributing plate rotates at relatively low speed, 160 to 180 R. P. M.

Material is fed into the stationary feed pipe usually from an elevator which takes the discharge from the grinding mill. The material falls directly on the revolving distributing plate and is thrown off in a thin sheet. The main or lifting fan near the top of the separator and directly above the separating chamber carries all but the coarsest material up into the separating chamber where the dust-laden air is caused to rotate by means of centrifugal vanes. This positive mechanical rotation generates a uniform centrifugal force throughout the ascending column of air, as the centrifugal force acts on the particles in direct proportion to their weight, the heavier ones reach the outside more quickly than the lighter ones and are thrown out of the ascending column of air before it reaches the opening in the fan chamber. The light particles remain in the air current and are carried into the fan chamber.

The heavier particles slide down the inner wall of the separating chamber, back to the "skirt" surrounding the distributing plate and falling off the lower edge of the separating chamber, pass through the incoming air. They are then discharged through the spout in the bottom of the tailings cone and sent back to the feed end of the grinder for regrinding.

The main fan discharges the air, carrying the fine particles in suspension into the outer casing or settling chamber imparting a rotary or cyclonic action which throws the suspended material against the outer wall down which it slides to the outlet at the bottom of the main separator cone. The air, freed of most of the dust, returns through a space between the separating chamber and tailings cone, passing around and through deflectors and baffles which remove the remaining dust from the air.

Regulation Insures Uniform Product

By varying the amount of centrifugal force created, the size of the particles entering the fan chamber can be regulated as desired, maintaining a uniform product. Changes in fineness can be made by removing or putting on plates increasing or decreasing the opening at the top of the separating chamber. The centrifugal force can be varied by removing or adding blades to the centrifugal fan. Moderate changes in fineness can be made from the outside of the machine while it is in operation by means of the adjustable deflectors, which act as a damper to retard the speed of the circulating air.

Gypsum-Anhydrite as a Cement Retarder

Committee C-11 of the American Society for Testing Materials, through the Bureau of Mines, is still at work on investigation dealing with the possible use of gypsum-anhydrite mixtures in the manufacture of portland cement for the purpose of retarding the time of set. At the meeting of the committee, held in Cleveland, October 27-28, at which the vice-chairman, F. A. Wilder, president, Southern Gypsum Co., Inc., North Holston, Va., presided, a report by Ernest Berger of the Bureau of Mines, on the use of calcium-sulfate retarders for portland cement, and a treatise entitled "The Hydration of Anhydrite" by Miss Marie Farnsworth, who is connected with the Non-Metallic Minerals Experiment Station of the Bureau of Standards at New Brunswick, N. J., were discussed.

W. E. Emley, chemist, U. S. Bureau of Standards, Washington, D. C., is chairman of the committee.

French Production of Bauxite

By ALFRED A. CAMERON

Vice Consul, Paris, France

The annual production of bauxite in France has been running well above 300,000 metric tons, attaining 340,000 in the calendar year 1924. Exports amounted to 167,081 tons in 1922, 192,508 in 1923, and 202,534 in 1924. During the first months of 1925 exportation was less than during the same period of 1924, the January and February total being less than two-thirds of that for those months in the preceding year. This is not peculiar to bauxite, however, for a similar or more marked decrease occurring in the exportation of all other nonferrous metals.

Principal Countries of Destination—Uses

The principal countries of destination for the exported bauxite are Switzerland (for the great factories at Neuhausen) and Great Britain (largely for the British Aluminum Co. in Scotland). Germany, Norway, Italy, and the United States take smaller amounts, in approximately the order named.

It is estimated that nine-tenths of the French bauxite produced in 1921 was used to make aluminum. Since then a new element has entered into the industry—the quick-setting hydraulic cement known as "ciment fondu," in which large quantities of bauxite are used.

No Export Prohibition Expected—Producing Centers

There has been some question during the past year of prohibiting the exportation of bauxite from France. The rumors to this effect, however, have not been confirmed and it is not now expected that such an action will be taken by the Government. It is true, however, that the French aluminum factories are expanding their productive capacity and, unless there is a considerable increase in bauxite production, prices of red bauxite suitable for refining may increase substantially in the near future.

The deposits of red bauxite are concentrated principally in the Departments of Var and Bouches du Rhone. The ore is shipped in cargo lots from St. Raphael (Var) and Port de Bouc (Bouches du Rhone).—*Commerce Reports.*

Fuller's Earth in 1924

According to Jefferson Middleton, of the United States Geological Survey the fuller's earth industry in 1924 was in a highly prosperous condition. The industry—a comparatively small one—has advanced steadily since 1912 except in one year, 1921, and the output of 13 operators in 6 states in 1924 was 177,994 short tons, valued at $2,632,342. This quantity was 19 per cent greater than that of 1923 and more than four times that of 1914. The value of the output for 1924 was also the largest ever recorded. It was 17 per cent greater than that of 1923, 5 per cent greater than that of 1920, previously the year of greatest value, and more than 6 times that of 1914. Since 1920 there has been a steady decline in the average value per ton of fuller's earth, the value in 1924—$14.79—being nearly five dollars lower than that of 1920, the year of highest average. The average value per ton in 1924 was higher than that of any year prior to 1919. Imports continued to decrease and in 1924 were the lowest in quantity since 1897.

Competition has confronted the industry from producers of the peculiar claylike materials of California, Nevada, Utah, and possibly other far western states, which are known locally as bentonite, Death Valley clay, leverrierite, montmorrillonite, etc., and which are said to be superior to the natural earth after treatment with sulphuric acid under a patented process.

*Blasting and the Use of Explosives

By FRANK F. McLAUGHLIN
Blasting Engineer, The France Stone Co., Toledo, Ohio

High explosives have become one of the great servants of our present civilization. Like other great giants in man's service such as steam, electricity, air, and fire, explosive effort must be directed and controlled lest harm, instead of good, be a result of its use. The control of any great energy is largely a matter of preparation for the direction of its effort. In other words, it is a matter of our driving the team instead of the team driving us.

Blasting is usually viewed as a necessary evil in the operation of a quarry—the war department of the industry, as it were. Every year a large number of blasting accidents occur, resulting in injury and death to many men. Because the accidents usually destroy the evidence, the actual causes of many blasting accidents are never fully determined; but, with few exceptions, a check on the previous conditions plus the results of an accident will prove that men, and not the explosives, primarily were the cause for disaster. If this statement is true, our hope of preventing blasting accidents is well founded. A man can be trained—a case of explosive cannot direct itself.

There is no such thing as a "safe" high explosive. We buy it and use it for what it is—an enormous potential energy chemically stored and harnessed for our service. We may as sensibly expect to avoid the natural results of contact with a high tension power line as to abort the known laws governing explosives and get away with a whole skin.

In face of all the death and injury incident to the use of explosives it is folly to expect to find some easy road of escape from the hazard. But blasting accidents are preventable. They are caused by ignorance, carelessness, and by the miscellaneous item called "the act of God." I put ignorance at the head of the list, and the densest comparative ignorance lies with the executive who hasn't sense enough to be afraid for himself and his men when he isn't sure of the right thing to do in blasting practice. Not many average working men are intentionally careless with explosives. They are afraid of it, and usually seek to get a blast over with as quickly as possible. Their ignorance, which created their fear and haste, produces a treble possibility for trouble. Haste is never a good tool for a normal job, and blasting can be made a normal part of your quarry operation. Therefore, neither haste nor ignorance has any place in safe, efficient, use of explosives.

High explosives will normally follow and be governed by fairly well known laws. It is an inanimate material, and can be controlled. Let us then really educate ourselves about this material and its use that we may avoid accidents and forget our fear of its use and power.

A Simple Letter Is the Purchase Price of Safety

Our government, through the Bureau of Mines, our states, through their various industrial commissions, the various explosive manufacturers, and our trade magazines will lay before us, for the asking, the work of literally hundreds of men who have labored on this subject for our benefit. The purchase price of safety for you and your men is only ordinarily a letter stating your wants and some common sense to interpret in your particular quarry what you will be told about explosives.

Lest some may think that blasting accidents are more largely caused by the material used rather than by a lack in the direction of its use, a word will be said here about the manufacture of explosives. It is a far cry from Nobel's simple mixture of nitrated glycerin and Fuller's earth to the perfected, controlled, high explosive of today. The unflagging effort of each generation of powder makers has reached a yet higher step in the progress of understanding and safety in the manufacture and use of explosives. Probably no other body of manufacturers so extend their interest beyond the manufacture and sale of their product as do the producers of explosives. As if in obedience to the old Christian code, where we would have them go a mile with us they have gladly gone two miles. They make every conceivable effort to protect a troublesome business from trouble. No explosive manufacturer can, for reasons that are clear, afford to have a series of disastrous events connected with his product. The Bureau of Mines constantly checks explosive products to keep the manufacturer from error even though his own company check through rule, laboratory, and supervision. The Bureau for the Safe Transportation of Explosives is another government agency that specifies details for explosive packing and transportation, specifying even the kind of cars explosives may be shipped in. The railroads are instructed to expedite delivery and discharge of the contents of a car of explosives. Nine thousand, nine hundred, ninety-nine times in ten thousand explosive shipments reach your plant siding practically as good as when they left the factory. This being the case, the arrival of the car on your siding ends the real responsibility of the manufacturer and the transportation company and your responsibility begins.

Chemicals of Many Explosives Deteriorate With Age

Every honest manager or superintendent wants to do the right thing. We err through lack of information. The long, safe way is the shortest good road between the two points involved. Take some thought about the hazards of fire and collision when locating the car for unloading, and about the course your wagon, truck, or men must take in transferring the cases from the car to the magazine. If it is wise for the manufacturer and our government to be concerned about these details it is foolish for us not to follow their example. Have a good road from the car to the magazine, and from the magazine to the quarry face. We have the men and material needed right at hand with which to build the best roads in the country. Not only is a good road an attraction to a visitor at your plant, not only does it reflect our own pride and neatness around the job, but it pays a real dividend, especially in bad weather. It is safe to transport cased explosives in a clean truck on a good road. Remember that you cannot know the exact condition of the contents of a case of explosives until the case is opened. Electric exploders and blasting caps should be handled like a crate of eggs, while powder fuse and cordeau will stand rougher treatment. As a rule don't jolt or jar explosives any more than absolutely necessary. Never toss or throw them, and be careful about the surface on which you slide them.

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*From a paper presented at the Fourteenth Annual Safety Congress, Cleveland, Ohio, Sept. 28 to Oct. 2.

The chemicals of many explosives deteriorate with age, and this tends to make them more and more insensitive to ordinary methods of detonation. This in turn leads to misfires in the blast. As far as possible, keep your explosive stock fresh—not over six months old. Many explosives deteriorate when allowed to become damp, or too hot or cold. Equip your plant with a clean, dry, well ventilated storage magazine located and erected to comply with the laws of your state. Keep explosives in a magazine separate from detonators of any sort. The government regulations applying to the packing of explosives require the manufacturer to rightly mark the boxes "This side up." They do not so mark the boxes in order to play a joke on you. "This side up" means *up*, not down, nor on the side, nor end. Store them in the magazine as instructed. A second magazine is necessary in which to store detonators, and indeed should embody all the virtues of a main explosives magazine. Have magazines large enough, but don't order more than you can store for there is no other place "just as good" in which to store the excess. Poor storage will cost you much money in impaired efficiency of the explosives and will considerably increase your chances of blasting accidents due to the changed condition of the explosive under poor storage. This applies to fuse and caps as well as to the explosive proper.

I want to make a few statements here about frozen or hardened explosives. Don't use explosives when in such condition! And don't thaw them, either, for most folks don't know the chemical they are trying to bring out of a congealed state in the thawing process. It takes an explosives chemist to be safe during such an operation. If it is necessary for you to store and use explosives in low temperatures there are manufacturers ready to supply you with a practically non-freezing explosive of many types. Don't use and don't thaw frozen or hardened explosives! Be suspicious of explosives that have a tendency to "stiffen up" in temperatures below forty degrees Fahrenheit. Make a practice of testing each cartridge used by gently trying to insert a small round wooden peg in the middle and at each end of the cartridge. If the peg meets resistance the explosive is in no condition to be used from either the viewpoint of efficiency or safety. A very large portion of the total of blasting accidents can be traced directly to the attempted use of frozen explosives.

If you were to make a blast today, yesterday was the right time to start it. By this is meant that intelligent preparation for a blast is, in itself, a large factor of safety. Blasting cannot be rightly accomplished without preparation. Be sensible about blasting, not fearful. Be deliberate. Take time and forethought to plan the details of a blast even more thoroughly than you plan the other major details of your quarry operation. Clean the bore holes to be used, even if it means taking the drill to do it. Clean away the loose stone from around the top of the holes. Run the drill tools down to the bottom of each hole, knocking down any lodged stone or wood in the hole, and spudding up the cuttings that have settled to the bottom. Bail the holes thoroughly, removing all the water possible. Some kinds of explosives decrease in efficiency very rapidly under contact with water, and this fact is a prolific source of misfired charges. If you don't already know how, get some experienced explosive man to show you how to measure the width, space, and depth that determine the tons burden of each bore hole. This information, plus your own experience in blasting your bank, will enable you to almost exactly determine the amount of explosive required for each separate hole so that when delivering the explosive from the magazine to the bank you can place the amount needed adjacent to each bore hole. The importance of this practice is mentioned later. See that the top surface of the blast is clear of the odds and ends that gather from drilling and stripping operations. You can't blame your men for stumbling and falling if they are compelled to move around in the midst of a lot of debris. Clear the shot and adjacent surface of electric power lines that are near the surface, especially when electric blasting caps are to be used. Whenever possible clean away the bottom of the face ahead of the shot before loading any holes. For a hole to explode, from any cause, with men working in front of the face of the shot, means almost certain death to those men. See that all the tools are on hand, and in good shape, that are usually required in loading bore holes on your quarry bank. Use only wooden tools—wooden tamping poles without exposed metal, a wooden peg spliced on a rope for lowering cartridges in the hole, a round wooden peg twelve or fourteen inches long for making hole in cartridges through which to lace detonators, a wooden mallet with which to open boxes, and a wooden box to hold detonators until used. Such preparation will go a long way toward inspiring confidence on the job.

Start Early Loading Bore Holes With Explosives

An old Chinese adage reads "He who rises late must trot all day." It is wise to get an early start loading bore holes with explosives. It is cooler early in the morning, heads are usually clearer, and the explosives will not have to remain so long in the sun on a hot day. Also, you won't be so pressed for time in finishing the job. Don't hurry. You are spending quite a sum of money in explosives, drilling and labor. You must think as well as work. Take time to protect your investment, and you will be taking the safe, sane, sensible course. There ought to be one man on every shot to do nothing but watch the workmen. The material will do nothing of its own accord. It is eternally the men that get into trouble with the material. If possible do not have the process of loading more than one hole at a time. This concentration makes security and efficiency possible, while their value is divided by the number of holes being loaded at the same time. Do not have any more men working on the blast than are absolutely necessary. Eliminate the guesser, the chance-taker, the curious visitor, the smoker, hob-nailed shoes, and matches.

Open the cases of explosives and detonators only as they are used, hole by hole. The cartridges are less exposed to sparks, heat and cold in the cases than they are out of them. Open the cases only with a wooden mallet, and when opened do not dump the contents on the ground. A little wind blows the sawdust packing in the men's eyes, a little spark sets the paper afire—and there you are with a possible accident looming up. Lift the cartridges from the box and lay them by the hole being loaded. You can then remove the box, paper, sawdust and all intact away from the shot. Do not start to load a hole until you are safe from sparks and lightning or stray electric currents. If a storm arises call your men to a point of safety away from the shot, and stay away until the storm has passed. Lightning will burn, explode, or detonate blasting caps, cordeau, and explosives. Inspect each bore hole just before loading it and see that it is a clear hole without obstructions to the bottom. A lodged piece of wood or a projecting stone in the hole means a jammed cartridge, and a consequent hazard created by trying to dislodge the cartridge. Your blaster is no vertical William Tell. I am not prepared to say just how far various explosives can be safely dropped in a bore hole, but by past experiences I am prepared to say, "don't drop it at all." It isn't necessary to drop it. Use a wooden peg hung on a rope, pushing the peg into the cartridge till friction holds it, and lower the cartridge with this tool down the bore hole.

When the cartridge is seated where you want it a slight, sharp, jerk will release the peg from the cartridge so that it can be drawn again to the top and the performance repeated until the hole is loaded. This loading practice does three things for you—it gets away from serious friction against explosive matter deposited on the walls of the bore hole as each succeeding cartridge is dropped; by means of measured knots or other marks on the length of the rope you can exactly determine where each cartridge is located; it avoids the possibility of jamming the cartridges in the hole and the consequent practice of dislodging the "hung" cartridge. A jammed or hung cartridge is probably the greatest single ally of the undertaker encountered in the use of explosives. Even the use of a wooden pole is no insurance when you poke and push and hammer away at a hung cartridge trying to dislodge it and force it on down into the hole. Often the detonator is cut in the above process. It is better to lose the hole than to treat a cartridge roughly. It is still better to avoid paying both penalties by lowering the explosive instead of trying to drop it in the hole. Again, I confess am not prepared to say just how much tamping can be safely done on various explosives, but I am prepared, by experience, and in the interest of safety, to say: do not tamp it at all. To tamp stemming in a bore hole is one thing, and quite all right if the detonator is not disturbed, but to tamp explosives is to freely invite the pallbearers and the preacher to your funeral. I know that some of you can tell me how many hundreds of times you have tamped explosive cartridges with a pole or bumper and "got by with it," but regardless of the supposed success of your past practice, you are still wrong if you want to be safe. It is better to gain explosive efficiency by bringing the cartridge diameter and the diameter of the bore hole closer to each other—and then be satisfied with the result and with an uninjured body.

Having the exact amount of explosives needed adjacent to each hole scatters the boxes over the shot where they are handy when needed as the loading progresses. This same scattering of the boxes divides the hazard of amount in one place to sparks, lightning and misfires. Sometimes it is necessary to break cartridges to smaller pieces to load obstructed holes. Remember that as such a hole is loaded the hole walls become somewhat coated with adhering explosive. It is wise not to tamp even the stemming in such a hole. After the explosives are loaded in a hole throw in at once enough stemming to protect the exposed explosive from any fire. Look well to the kind of stemming or tamping used. In most quarries the finer size rock dust is used for this purpose. It serves very well, but keep the dust free from larger size rocks that might cut the fuse, wires, or cordeau while being tamped on the explosive charge.

Use Only Experienced Men to "Hook Up" the Shot

We are all prone to give a sigh of relief when the last hole of a shot is loaded and tamped, and indeed quite a bit of our blasting hazard is over; but even though the details of your quarry operation press you hard for the stone in this blast take your time while connecting the detonators on the shot and make sure it is rightly done. Use only experienced men to "hook up" the shot. Make a final inspection of all connections after the men, with their sometimes blundering feet, have been sent away. A poor connection of the detonators means a missed hole, and a missed hole not only means a poorer shot but passes a hazard to the shovel crew who have no good way to protect themselves. When you are finally ready to make the blast take the further step of assuring yourself that men and equipment are in the clear. See that they are even more than sufficiently safe, for a blast will sometimes fool even the best "guesser" on the job as to where it will land. Make sure, by instruction and practice, that your men, especially the new ones, recognize whatever type of blast warning signal you use. It goes almost without saying that you will take steps to protect nearby transportation highways and residents from possible flying stone from the blast.

If you shoot with electricity do not connect the shot with the power line or battery until the main switch and fuses are pulled. In damp conditions, where there is a possibility of a ground through the switch block, go even so far as to disconnect the wires leading from the switch or battery to the shot until everything is ready to make the blast. It is a good practice to have a man stationed constantly by and in charge of the battering or firing switch from the time the detonators are being connected until the blast is made. If the shot is fired with a fuse and cap it is well to make a second, or "dummy" fuse and cap six inches shorter than the main shot fuse. Light this "dummy"' first when lighting the shot fuse and on its exploding the cap you will know within fifteen or twenty seconds when to expect the blast to go. If the powder fuse has been kept dry and is not kinked it will follow the manufacturer's rate of burning very closely, but no dependence should be put on a fuse in poor condition. In case of doubt about a fuse, that has been lighted and does not explode the cap in reasonable time for its length, wait at least an hour before approaching it to discover the cause. Some very peculiar things have happened with poor fuse. Having successfully accomplished the loading and firing of a blast, do not be hasty in returning into the fumes and smoke that nearly always surround the blasted rock. Be sure to wait in damp weather.

The same general sense applies to secondary, or pop, blasting as has been said about the blast. Have a couple of small storage magazines in the quarry handy to the work, one for explosives, and one for detonators. Pick out a steady reliable man for this work. After all is said and done, safety or hazard goes as the man goes. Beware of the fellow who carries explosives or caps around the shovel or locomotive in an open box, or who carries caps or explosives or both in his pockets, or who crimps caps on fuse with his teeth or a knife, or who wants to save you money by using short length fuses, or who takes pride in the large number of fuses he can light at one time and get away with it. The practice of lighting a "dummy" fuse shorter than any used in the small hole shots, lighted first, and used as a warning signal to get under cover, is a good way to avoid trouble with this part of blasting.

In closing I offer this word to you men who are executives in quarry operations—none of these suggested safe practices about blasting, and the use of explosives, will cost you very much money. Compensation for the injured and killed calls for a good sized check. An informed, reliable, man is needed for supervision every time major blasting is done in a quarry if safety is to be a companion with your blasting. Let such a man have your confidence. Educate him constantly that he in turn may educate the men who must handle and use explosives in your quarry that they may come contented to work in the morning and go home safe and happy at night.

"A laugh is worth a hundred groans in any market."

Portland Cement Output in October, 1925

Production of portland cement in October is second only to that of August, 1925, and shows an increase of nearly 8% over October, 1924, according to statistics compiled by the Bureau of Mines, Department of Commerce. The seasonal decline in the shipments of portland cement is shown by a decrease of 2,402,000 barrels in October as compared with September, 1925. This downward trend has begun one month earlier than in 1924. Stocks of portland cement are 80% greater than on October 31, 1924. The following tables prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines are based mainly on the reports of producers of portland cement. The October, 1925, totals include estimates for one plant.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1924 AND 1925, IN THOUSANDS OF BARRELS

	Production		Shipments		Stocks at end of month	
Month—	1924	1925	1924	1925	1924	1925
January	8,788	8,856	5,210	5,162	14,155	17,656
February	8,588	8,255	5,933	6,015	16,815	19,689
March	10.370	11,034	8,995	10,279	18,189	20,469
First quarter	27,746	28,145	20,138	21,456	—	—
April	11,726	13,807	12,771	14,394	17,159	19,877
May	13,777	15,503	14,551	16,735	16,403	18,440
June	13.538	15,387	15,036	17,501	14,903	16,409
Second quarter	39,041	44,697	42,358	48,630	—	—
July	14,029	15,641	16,614	18,131	12,319	13,896
August	15,128	16,419	16,855	18,383	10,666	11,952
September	14,519	15,939	16,827	17,711	8,404	*10,247
Third quarter	43,676	47,999	50,296	54,225	—	—
October	14.820	15,992	17,160	15,309	6,073	10,930
November	13,141	—	10,289	—	8,928	—
December	10,435	—	5,506	—	13,913	—
Fourth quarter	38.396	—	32,955	—	—	—
	148.859	—	145,747	—	—	—

*Revised.

ESTIMATED CLINKER (UNGROUND CEMENT) AT MILLS AT END OF EACH MONTH, 1924 AND 1925, IN THOUSANDS OF BARRELS

Month	1924	1925	Month	1924	1925
January	5,458	7,017	July	6,646	6,961
February	6.905	8,497	August	5,367	5,640
March	8.271	9,962	September	4,260	4,561*
April	8.545	9,731	October	3,548	4,082
May	8.225	9,053	November	4,025	—
June	7.609	7,937	December	5,433	—

*Revised.

Statistics compiled from the records of the Bureau of Foreign and Domestic Commerce for the month of September, 1925, show that the grand total of imports of hydraulic cement for that month was 513,258 barrels, valued at $789,152. Belgium imported 197,406 barrels, valued at $291,536. Canada ranked higher with a total of 233,115 barrels, valued at $347,406, a large percentage of which was imported into the Saint Lawrence and Florida districts.

The total exports to Canada, Cuba, South America, Mexico and other countries in September amounted to 102,649 barrels, valued at $285,225. Domestic hydraulic cement shipped to Alaska, Hawaii and Porto Rico in September, 1925, totaled 20,197 barrels, valued at $48,026, 16,440 barrels going to Porto Rico. Figures on imports and exports for October are not available.

Ten Years of Chemical Progress Epitomized at Chemical Exposition

Ten years of American chemical progress were epitomized at the Tenth Exposition of Chemical Industries, which closed at the Grand Central Palace, New York City, on October 3, after one of the most successful expositions ever held in the United States. Of the 67,836 persons who visited the exposition, 12,464 registered as representing some branch of a chemical, chemical process or chemical consuming industry.

There were slightly less than 400 exhibits from industrial organizations and everything from the finest precision instruments up to large scale filter presses, evaporators and chemical kettles were displayed.

A one-week intensive course in the fundamentals of industrial chemistry and chemical egineering for students of chemistry or chemical engineering from various colleges and universities throughout the country was well attended and included lectures and practical demonstrations.

View of the interior of the Grand Central Palace showing some of the exhibits at the Tenth Exposition of Chemical Industries

Mineral Screening Apparatus Not New

Screening apparatus may be older than civilization, state E. A. Holbrook and Thomas Fraser, in Bulletin 234, on screen sizing of coal, ores, and other minerals, just published by the Bureau of Mines, Department of Commerce. The coarsely woven baskets or the rough cloth used by primitive people for carrying loose materials may have suggested the idea; even before this one experience of picking up a handful of beach sand and having it sift gently through the fingers might have supplied the idea for a bar screen.

In the middle ages Agricola described the application of screens, used both wet and dry, in metal mining. His illustrations show hand screens not unlike the common hand riddles used today, except that, as metals were scarce, such a screen was often only a wooden trough with holes bored at intervals.

One of the first modern references to coal-mining screens gives the following information for 1740: "In this year the mischievous practice of screening coals was first introduced at Willington colliery by Mr. William Brown." At first the screen apertures were made very narrow, but by 1770 the bars were placed farther apart, widening the openings considerably. Since coal operators and miners in this country have had numerous disputes on the use of screens in the past 30 years, it is interesting to note that more than 150 years ago the practice of screening coal was termed "mischievous," and that record was made of the enlargement of the apertures.

Producers Discuss Plant Problems

Annual Meeting of Portland Cement Association Held in Chicago with Record-Breaking Attendance

All records of attendance at Portland Cement Association meetings were broken by the attendance at the annual meeting held at the Drake Hotel, Chicago, November 16 to 18 inclusive. More than 365 individuals representing 75 companies registered.

As usual, the first day's sessions were given over to the preparation of reports of Standing Committees for presentation at the general business session on Wednesday.

Tuesday was devoted to sessions for discussion of technical problems and mill practice relative to the manufacturing side of cement. The cement industry, as typified by the membership of the Portland Cement Association, has for a number of years been making notable records in the way of accident prevention. In June of this year, practically all of the member plants conducted a "No Accident" campaign, with the result that 72 of the 125 plants which entered the contest went through the month without a single time-lost accident. Certificates of merit were awarded to the plants having a clear record.

The regular business session and election of officers was held Wednesday, November 18. The following officers were re-elected: President, Blaine S. Smith, General Sales Manager, Universal Portland Cement Co.; First Vice President, Lowell R. Burch, Vice President, Atlas Portland Cement Co.; Second Vice President, C. A. Irvin, Vice President, Alpha Portland Cement Co.; Treasurer, John W. Boardman, Vice President, Huron and Wyandotte Portland Cement Companies.

In addition, the following were elected to the Board of Directors: John Treanor, H. Struckmann, L. C. Morton, H. F. Jennings, Charles Boettcher and William S. Speed.

In addressing the membership at the business session, President Smith called attention to the favorable outlook for the construction industry and presented a brief summary of construction in 1925.

Mr. Smith said: "Many cities have lagged behind in necessary facilities for sewage disposal, water filtration plants and other municipal and civic improvements having important connection with community health and welfare.

"With the financial recovery of the farmer an established fact, with general business conditions good, and with the need for municipal improvements and industrial enlargements, 1926 presents a favorable outlook for the construction industry.

"Awards for the first ten months of this year for concrete pavements are greater than for any twelve months on record. The equivalent of 5,752 miles of 18-foot road were completed and placed under traffic from January 1 to October 31, 1925.

"The need for more roads and wider roads is indicated by the fact that over 17,000,000 of the 19,500,000 cars in the world are in the United States. Estimating 1925 U. S. production of new vehicles at 3,800,000, the space needed merely to store these cars would require 4,318 miles of 18-foot road. To keep them moving requires much more, so that the 5,752 miles of concrete roads built in 1925 are not nearly sufficient to accommodate the growing motor traffic.

"In the cement industry, the year has been marked as one of ample supply of cement.

"Although shipments for 1925 will doubtless exceed those of last year, stocks have consistently been higher than in 1924. The explanation lies in the large increase in cement manufacturing capacity made during recent years, which have brought productive capacity up to an estimated total of more than 185,000,000 barrels a year, or some 25 per cent in excess of the largest year's demand."

At the conclusion of the business session about 250 of those in attendance took busses from the Drake to the site of the Association's new building, Grand Avenue and Dearborn Streets, to participate in the cornerstone laying ceremony.

The principal address was by Robert W. Lesley, of Philadelphia, one of the organizers of the Portland Cement Association, and its first President.

Other addresses were made by Blaine S. Smith, President of the Association, and by B. F. Affleck, President, Universal Portland Cement Co., and Chairman of the Association's Building Committee.

The cornerstone laying marked the culmination of several years of planning on the part of the Association toward the end of owning and occupying its own home.

A banquet winding up the three-days' sessions was held at the Drake, Wednesday evening. One of the speakers was United States Senator Arthur Capper, nationally known also as a publisher of many farm papers and the *Topeka Capital.* Senator Capper spoke on "The Farmer's Yesterday and Tomorrow."

Another speaker was John J. Earley, well known architectural sculptor of Washington, D. C. Mr. Earley's talk was on "The Concrete of the Artist and of the Architect."

Underground Mining of Limestone

Limestone, which finds industrial use in the United States to the extent of approximately 120,000,000 tons per year, is obtained chiefly from open-pit quarries, but with gradual depletion of surface deposits, more and more operators are being forced to use underground methods. As quarrymen are not necessarily familiar with underground mining, a complete study of the mining of limestone in this manner has been made by engineers of the Bureau of Mines, Department of Commerce, with the object of determining the methods in use, ascertaining what constitutes good and bad practice, and suggesting improvements in methods when practicable. As a result, complete data were obtained, with the hearty cooperation of the industry, on 52 of the 64 mines known to have underground workings. The information obtained by the Bureau of Mines will be embodied in publications to be issued within the comparatively near future.

St. Louis-San Francisco R. R. tariffs purporting to accord transit at Ada, Oklahoma, under which crushed limestone and shale obtained by the Oklahoma Portland Cement Co. at Lawrence and Lantry, can be manufactured into cement and shipped beyond over the railway's lines at lower through charges than when moving over competitive lines has been found by the Interstate Commerce Commission to be vague and contradictory and the carrier has been ordered to cancel the tariffs insofar as they are applicable to interstate traffic.

Arkansas to Have New Cement Plant

The possibilities of the reopening of operations at the large lime deposit at White Cliffs, Arkansas, now seems assured, upon the recording of deeds at Ashdown by the White Cliffs Corporation and the Arkansas Cement Corporation. Both corporations are chartered under the laws of the State of Delaware, with a total capital of $9,000,000. The deeds convey the title of the property formerly owned by the Krippendorf-Tuttle White Cliffs Products Co., the consideration being $375,000.

The plan of the new corporation is to first build a large cement plant and run this in connection with the present plant located there. The building of the cement plant will begin at once and will employ at least 500 men, it is reported locally. The present plant which is for the manufacture of whiting and asphalt filler will start at once.

The property conveyed in the deeds consists of 900 acres of fine limestone deposit located in Little River County. The first plant at White Cliffs was built in the early nineties, by a company from Holland, who built a large cement plant on the east bank of Little River. The Kansas City Southern Railroad Co. built a spur from its line to the west bank of the river, and all products from the plant were shipped over this line, but having no bridge across the river a cable was used, together with large buckets in taking the products from the plant across to the railroad.

This Holland company was forced into bankruptcy and several years after, the entire plant was dismantled and sold as junk. The two tall chimneys which were the highest in Arkansas at that time, were torn down, and one by one the homes of the officials of the company were burned, the last one being on the highest point, and with it went all the furniture, which had been imported from Holland.

A few years ago, another company was organized to build a plant and operate the lime deposit, this one being the Krippendorf-Tuttle Co. of Cincinnati, Ohio.

This plant was for the manufacture of whiting and other products. The buildings were on the same location as the former plant and cost over a million dollars. Together with the plant, this company built school houses and homes for the employes.

This company after spending over a million dollars, also was forced to cease operation because of the large overhead expense and only the watchmen have been on duty at White Cliffs for the past two and a half years.

Canadian Lime Plants Have Dull Season

Repairs have been made to the lime manufacturing plants of Randolph & Baker, Limited, at Randolph, N. B., which were almost entirely destroyed by fire. The lime producing plants at Randolph are among the oldest established in America and have been operated steadily. For more than eighty years, the properties have been in the possession of the Fitz Randolph family. The outlook is that for the opening of the 1926 lime manufacturing season the Randolph plants will be ready for 100% operation. During the winter the plants are idle.

Lime manufacturers in New Brunswick are wondering what the 1926 season will hold out for them. The 1925 season was unsatisfactory. In fact, conditions reached such a low ebb that some of the plants were shut down in mid-season. Others were operated at about 35% capacity. The demand for lime from the United States was very low. Many of the manufacturers are figuring on a good season for 1926. However, if the demand from the United States is slight, the season will be poor, as the United States market is always the backbone of the Canadian lime industry.

The Stetson-Cutler Co., Ltd., operating lime manufacturing plants at the mouth of the St. John River and also along the Restigouche River, exhibited lime produced at the company's plants at the annual fall fairs held in eastern Canada. This company specializes in Black Rock lime. The name is derived from the black lime rock quarries of the concern. For more than 40 years, the plants at the mouth of the St. John River have been operated, but in 1925, operations were curtailed owing to the limited demand. The Stetson-Cutler interests were among the first of the United States companies to develop lime manufacturing in Canada, the company being financed in Boston, and with executives from Massachusetts and Maine. About a year ago, the company was taken over by the Fraser interests, operating under the name of the Fraser Companies, Ltd., in which United States capital is also heavily interested. The Stetson-Cutler Co., Ltd., will continue to operate under the original name, as a unit in the Fraser holdings. F. C. Beatteay, who was manager of the Stetson-Cutler Co. for about 20 years, remains in charge under the new ownership.

Recent shipments of lime from New Brunswick ports to the United States have been few and far between. Schooners that have been used to transport lime solely, in the voyages to the United States, picking up cargoes of coal for the return trip, have not carried 40% of the lime formerly loaded at the ports of St. John, St. Martins, and other ports.

The decreased demand in the building industry in the United States has been a staggering blow to the Canadian lime industry. In some of the ports, the shipments of lime to the United States have not been more than 15% of the volume shipped in satisfactory seasons. Taken all in all, the 1925 season was one of the most unsatisfactory in the annals of lime manufacturing. The home market as well as the United States demand falling far below normal.

Acme Cement Corporation to Expand

The Acme Cement Corporation expects to spend approximately $1,000,000 in bringing its plant up to date in every respect including the installation of new machinery which will greatly reduce the cost of plant operation. The present equipment will be rearranged to fit in with the general plans.

McClellan & Junkersfeld of New York City have been retained as engineers in charge of the work and a contract has been awarded to the Turner Construction Co., for concrete construction involved. Barracks in which to house the 150 men to be employed through the winter are being erected. The Acme plant now has about 250 men employed in the manufacture of cement and continuous operation will be kept up while the improvements are under way. When the reconstructed plant is in operation the capacity will be considerably over 1,000,000 bbls. per year.

Universal Cement Prices

The following tabulation of current net prices of cement to contractors per barrel in carload lots, f. o. b. the points listed, was announced by the Universal Portland Cement Co., effective October 16:

Cedar Rapids	$2.34	Duluth	$2.09
Chicago	2.10	Indianapolis	2.29
Cincinnati	2.37	Minneapolis	2.32
Cleveland	2.29	St. Paul	2.32
Davenport	2.29	Peoria	2.27
		Pittsburgh	2.09

Prices effective October 22 at Detroit and Toledo, were $2.15 and $2.20 respectively.

Men and Mills

Notes from the Field

The twenty-third quarterly report of the International Cement Corporation, covering the third quarter of 1925 shows that the "Net to Surplus" for the third quarter amounted to $1,352,898.03 compared with $1,110,603.02 for the second quarter and $713,938.78 for the first quarter; a total for the nine months of $3,177,439.83 as compared with $2,041,729.57 for the first nine months of 1924. These earnings after allowing for preferred dividends are equivalent to $5.79 per share for nine months on the 500,000 shares of common stock now outstanding.

The Warrior Cement Corporation with offices at 705 Battle Place, Chattanooga, Tenn., recently awarded a contract to the Bland Engineering Co., Minneapolis, Minn., for the erection of a silo storage and packing plant. The capacity of the silo is reported to be 110,000 bbls.

The plant of the Warrior company is at Spocari, Ala., and correspondence regarding orders, bills of lading, invoices, etc., should be addressed to the plant office at Spocari, according to an announcement recently attributed to President A. C. Deer.

John W. Lowell, formerly assistant manager of the service bureau of the Universal Portland Cement Co., Chicago, Ill., has resigned to become vice-president of Benedict Stone, Inc., Chicago.

A contract is reported to have been awarded by the Indiana Portland Cement Co., Limedale, Ind., a subsidiary of the International Cement Corporation, to the State Construction Co. of Indianapolis, for a two-story and basement structure 50 ft. x 100 ft., part of which is to be used as a laboratory.

The Portland Cement Association and the National Lime Association are included among organizations represented at a recent conference at Washington, D. C., which decided to call a general meeting of representatives of more than 200 industries to protest against governmental activities which are declared to be encroaching upon the field of private business.

F. B. Gerard, chief engineer of the Boyne City Portland Cement Co., Boyne City, Mich., has accepted a position in Lima, Peru. The Foundation Co., New York City, is engaged in beautifying several of the cities of the Pacific coast countries of South America, and will manufacture the cement with the American engineer in charge. Mr. Gerard was connected with English and Canadian enterprises before going to Boyne City.

Frank W. MacCannon, cashier and credit manager of the Colorado Portland Cement Co., died at his Denver home, November 13, aged 55, of heart disease. Mr. MacCannon was born at Nathrop, Colorado, and before going to Denver was in the hardware business at Leadville. He had been with the cement concern since 1917. Surviving him are his widow, one son, one daughter; his mother and one sister, Miss Ethel MacCannon, who is connected with the Henry L. Doherty Co., New York.

H. E. Hilts, formerly deputy engineering executive and deputy highway commissioner of the State of Pennsylvania, has been appointed assistant manager of the Virginia Portland Cement Co., with headquarters at Norfolk, Va.

The explosion of a blast in a new quarry of the Acme Cement Co., near Catskill, N. Y., destroyed one dwelling and damaged another, both of which belonged to the cement company. The house destroyed had been occupied up to the time of the blast but its occupant had been warned of the danger and, although much of the furniture and other utensils were destroyed, no one was injured. The blast was in a new section of the quarry.

A mortgage of $1,500,000 is to be retired by the Certainteed Products Co. on its holdings near Centerville, Iowa, which include 15 acres of land and the mineral rights to a large acreage adjoining. It is the conviction of many in the locality that the Certainteed company will eventually build a large gypsum producing branch on the property.

Joseph Holmes, an employe of the Acme Cement Corp., was very seriously injured on October 31, when he slipped into a clay mixing pit in such a way that both his legs were so mangled that amputation was necessary. Holmes was working alone at the time of the accident and it is thought that he slipped so that both legs went through the grate guarding the clay mixer.

The directors of the Alpha Portland Cement Co., with main offices at Easton, Pa., have declared a stock dividend of 25% payable December 10 to holders of common stock as of record on November 20. Earnings for the past few years in excess of those necessary for the regular annual dividends have been put back into the plants with the result that increased efficiency and output have been marked.

The Tidewater Portland Cement Co., which has been in the hands of receivers for the past several months, has been bought by the Lehigh Portland Cement Co., according to advice recently received, which gives the purchase price as $3,305,000. The Tidewater plant is at Union Bridge, Md. Other bids were received for the plant, including that of the North American Cement Corporation.

Plans are rapidly materializing for the rehabilitation of the old Choctaw Portland Cement Company's plant at Hartshorn, Okla., by the installation of new and modern machinery to replace the old, and to enlarge the capacity to 5,000 bbls. per day. It is reported to be the purpose of the company negotiating for the property to make it one of the largest plants in the west. It is expected that work of cleaning up preparatory to starting construction work will be started before the end of the year.

The Nebraska Cement Co., before John H. Howell, examiner for the interstate commerce commission, meeting in the Colorado Public Utilities Commission office, charged the Denver & Salt Lake and the Chicago Burlington & Quincy railroads, between June 1 to September 20, 1923, assessed it $4.92 a ton for hauling coal from northern Colorado mines to Superior, Nebraska, an alleged violation of an interstate commerce commission ruling fixing the maximum charge for such a haul at $4.30. The case will be investigated and a refund ordered if correct.

The incorporation of the Adamant Portland Cement Corp., with a capitalization of $4,000,000, is reported from Mason City, Ia. The names of the incorporators are given as T. T. Blaise, Mason City, and C. J. Lambert and H. S. Boyes, Sigourney, Ia.

The Alabama Power Co., which supplies power for four of the five large Alabama cement plants, despite the shrinkage in the hydro-electric power generation by reason of the continued drouth and the low stage of the water in the Coosa river, has been supplying its ever increasing demand for power. Ten of the company's steam electric plants have been put into use.

An interim dividend was declared on the ordinary shares of the British Portland Cement Co., Ltd., of 5% (less tax), payable October 14, being the same as for several years past.

Gordon Tongue, of the Superior Portland Cement Co., was elected president of the Sales Managers' Association of Seattle, an affiliate organization of the Chamber of Commerce.

Reports from New Orleans are to the effect that the Alabama Portland Cement Co. will commence construction of a new cement plant before January 1, on a site leased on the industrial canal at New Orleans.

Sixty-six thousand sacks of cement made at Hannibal, Mo., by the Atlas Portland Cement Co., were recently delivered at Miami, Fla., by the steamer Ellenor. The cement was transported down the Mississippi river from Hannibal and put aboard the Ellenor at New Orleans.

It was announced the latter part of October by the Clinchfield Portland Cement Corporation that contracts would be let immediately for the installation of a third unit at Clinchfield Plant No. 2, Clinchfield, Georgia.

This new unit will include an additional kiln 175 ft. long by 10 ft. in diameter and appurtenances. Work will proceed at once and it is hoped to have this additional unit in operation by April 1, 1926, bringing the production of this plant up to 1,000,000 bbls. per year.

Directors of the Missouri Portland Cement Co. have voted to retire $491,000 worth of the company's bonds, according to a report from St. Louis. The bonds will be retired at 105 on January 1, next, leaving only $463,000 worth of bonds outstanding after that date.

Expansion of the Leeds, Alabama, plant of the Atlas Portland Cement Co. is indicated by the reported plans for the installation of a new unit.

New machinery, new buildings, new track facilities and new conveniences for the men employed at the plant are included in the work being done at the plant of the Edison Portland Cement Co. at New Village, N. J. It is estimated that these improvements when completed will have cost nearly a half million dollars.

New concrete buildings now under construction will replace the temporary structures that have been used since the company's packing house and bag house were destroyed by fire over a year ago.

A new incline is being constructed from the quarry, to be operated by an electric hoist. A change house for the men will be equipped with lockers and shower baths. The railroad storage yard is also being enlarged and will have an ultimate capacity of nearly 200 cars.

Trade Publications

Standard Milburn Regulators issued by the Alexander Milburn Co., Baltimore, Md., is an 8-page illustrated circular describing Milburn equipment for accurate gas delivery and for the reduction of varying gas pressures to that required for the welding and cutting art, for industrial and scientific purposes as well as army and navy uses. The circular, designated as Bulletin No. 200A, is 8½x11 in.

The Republic Flow Meters Co., Chicago, Ill., began about a year ago to publish a series of articles on *Boiler Room Operation* by Professor G. F. Gebhart, head of the Mechanical Engineering Dept. of the Armour Institute of Technology. These articles which are available from the Republic company present to modern industry information on the latest methods of increasing power plant efficiency. The following articles are typical: Heat Losses; Air for Combustion; Heat Transmission in Steam Boilers; Boiler Efficiency; Preliminary Plant Survey. Further articles will be published at approximate monthly intervals.

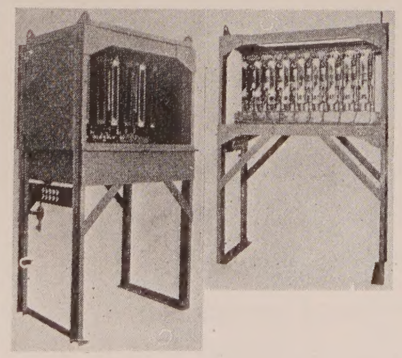
Under the title, *Belted Synchronous Motors*, the Electric Machinery Mfg. Co., Minneapolis, Minn., has issued Bulletin 812, describing E-M synchronous motors of types designed for belted installations. The bulletin is 8½x11 in., fully illustrated, giving details of construction, ratings, and a table of amperes required by three-phase synchronous motors.

The W. W. Sly Manufacturing Co., Cleveland, Ohio, has issued a four-page folder 8½x11 in., entitled *Dust or Dollars*, describing briefly the Sly dust arrester. Information given includes data as to the standard sizes, the dust arrester case, doors for access, dust hoppers, screens, removal of dust and rapping device drive.

Brown Indicating and Recording Tachometers is the title given catalog No. 44, issued by the Brown Instrument Co., Philadelphia, Pa., describing instruments for measuring or counting revolutions per minute. The catalog is 8½x11 in., 12 pages, and is well illustrated with photographic reproductions and diagrams. Sample charts are reproduced showing how the records are made.

Electro-Pneumatic Hoist Control

Outstanding features claimed for the electro-pneumatic hoist control system developed and manufactured by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and shown in the accompanying illustration, are its quiet and positive operation, added safety factor and low maintenance costs for controlling large induction motors on hoist service. The control selected by the Consolidated Coal Co. to install at its Juno mine will consist of electro-pneumatic switches giving nine speed-control points for either forward or reverse operation, equipped with the usual auxiliaries and safety features. The hoist will be driven by a 1,000 h.p. induction motor, using three phase, 60 cycle current at 2,200 volts. The motor has a maximum temperature rating of 40° Cent., and will operate at 300 r.p.m.

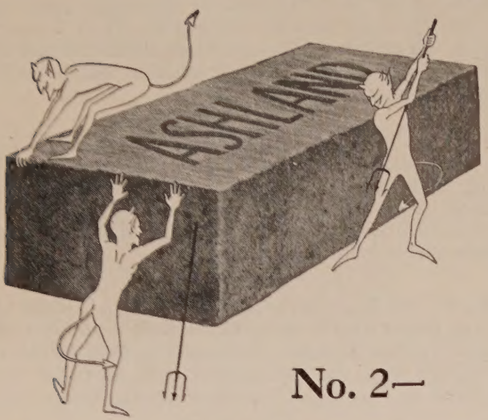


(Left)—Primary reversing switch group, cover off to show management

(Right) — Secondary switch group, showing arrangement of accelerating switches

The

Little Devils of High Temperature Service!



No. 2—

Expansion & Contraction

PULLING, pushing and cracking brick work is one of the favorite pastimes of the little expansion and contraction devils that exert such a destructive influence on fire brick construction.

Meet the attack with Ashland Fire Brick of Kentucky fire clays. Its limit of expansion and contraction is only ½ and ⅓, respectively, of the amount permissible for high heat duty fire brick.

SALES OFFICES:
New York Chicago Cleveland Detroit
Indianapolis Havana, Cuba

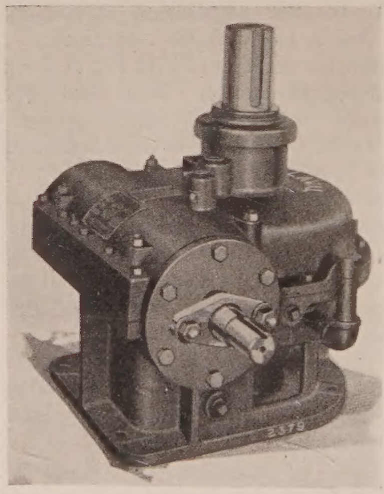
ASHLAND FIRE BRICK CO.
Incorporated *1886*
ASHLAND, KENTUCKY
Manufacturers Of Sized Brick

Worm Reduction Gear for Vertical Shaft Drive

Worm reduction gears, in addition to reliability, compactness, simplicity and efficient operation, also have the valuable peculiarity that the driven shaft is at right angles to the driving shaft. Where the driven shaft is horizontal, this permits the motor to be located out of the way, alongside the machine, instead of projecting out across aisle space. For vertical shaft drives, it is even more convenient, since it does away with bevel gears and vertical belts, which are always more or less troublesome. It is ideal for vertical agitators, autoclaves, mixers, chaser pan mills, etc.

The accompanying illustration shows a worm reduction gear for vertical shaft drive recently developed by the De Laval Steam Turbine Co., of Trenton, N. J. The gear casing supports the worm bearings and also the lower bearing of the driven shaft, while the upper shaft bearing is held by the casing cover. The oil is carried at such a level that the worm and gear wheel dip into it, thus insuring copious lubrication. The lower wheel shaft bearing is always immersed in oil and has spiral grooves to insure circulation of the oil.

To provide oil for the upper wheel bearing and thrust plate, a small reciprocating oil pump is incorporated in the casing cover. The plunger of the pump projects downwardly against a cam. The rotation of the cam actuates the plunger, which, by means of ball check valves, draws in oil through the suction pipe projecting from the under surface of the cover down into the oil in the casing. Suitable filling and drainage openings, together with a try-cock, provide for control of the oil level. With this type of speed reducer, inspection of the oil level at long intervals is about the only attention required.



De Laval worm reduction gear for vertical shaft drive

For larger size reductions, where the worms run at fairly high speeds, it is not desirable to immerse the worm and wheel on account of fluid friction, according to the manufacturers, and a positive pressure oiling system is therefore used to feed oil to all the bearings and to the worm threads and gear teeth at the contact points. A full line of these drives is made and drives can be had with the shaft extending either upward or downward.

The Superior Court of Cook County, Illinois, has held that the anti-injunction law passed by the state legislature at its last session is constitutional.